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NOTIFICATION OF TRANSMITTAL
OF COPIES OF TRANSLATION
OF THE INTERNATIONAL PRELIMINARY REPORT
ON PATENTABILITY
(CHAPTER I OR CHAPTER II
OF THE PATENT COOPERATION TREATY)
(PCT Rule 72.2)

From the INTERNATIONAL BUREAU

To:

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Date of mailing (day/month/year)
21 July 2005 (21.07.2005)

Applicant's or agent's file reference
02/117 WO

IMPORTANT NOTIFICATION

International application No.
PCT/CH2003/000700

International filing date (day/month/year)
27 October 2003 (27.10.2003)

Applicant

ABB RESEARCH LTD et al

1. Transmittal of the translation to the applicant.

The International Bureau transmits herewith a copy of the English translation made by the International Bureau of the international preliminary examination report established by the International Preliminary Examining Authority.

2. Transmittal of the copy of the translation to the elected Offices.

The International Bureau notifies the applicant that copies of that translation have been transmitted to the following elected Offices requiring such translation:

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3. Reminder regarding translation into (one of) the official language(s) of the elected Office(s).

The applicant is reminded that, where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report.

It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned (Rule 74.1). See Volume II of the PCT Applicant's Guide for further details.

The International Bureau of WIPO
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Translation

PATENT COOPERATION TREATY

PCT/CH2003/000700



PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 02/117 WO	FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/CH2003/000700	International filing date (day/month/year) 27 October 2003 (27.10.2003)	Priority date (day/month/year) 27 November 2002 (27.11.2002)
International Patent Classification (IPC) or national classification and IPC H01L 23/29		
Applicant ABB RESEARCH LTD		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of <u>7</u> sheets, including this cover sheet.
<input checked="" type="checkbox"/> This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).
These annexes consist of a total of <u>2</u> sheets.
3. This report contains indications relating to the following items:
I <input checked="" type="checkbox"/> Basis of the report
II <input type="checkbox"/> Priority
III <input type="checkbox"/> Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
IV <input type="checkbox"/> Lack of unity of invention
V <input checked="" type="checkbox"/> Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
VI <input type="checkbox"/> Certain documents cited
VII <input type="checkbox"/> Certain defects in the international application
VIII <input type="checkbox"/> Certain observations on the international application

Date of submission of the demand 01 July 2004 (01.07.2004)	Date of completion of this report 21 March 2005 (21.03.2005)
Name and mailing address of the IPEA/EP	Authorized officer
Facsimile No.	Telephone No.

I. Basis of the report**1. With regard to the elements of the international application:***

- ☐ the international application as originally filed
- ☒ the description:
pages _____ 1-10 _____, as originally filed
pages _____, filed with the demand
pages _____, filed with the letter of _____
- ☒ the claims:
pages _____, as originally filed
pages _____, as amended (together with any statement under Article 19
pages _____, filed with the demand
pages _____ 1-13 _____, filed with the letter of _____ 26 January 2005 (26.01.2005)
- ☒ the drawings:
pages _____, as originally filed
pages _____, filed with the demand
pages _____, filed with the letter of _____
- ☐ the sequence listing part of the description:
pages _____ 1/2-2/2 _____, as originally filed
pages _____, filed with the demand
pages _____, filed with the letter of _____

2. With regard to the language, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language _____ which is:

- ☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of the translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. ☐ The amendments have resulted in the cancellation of:

- ☐ the description, pages _____
- ☐ the claims, Nos. _____
- ☐ the drawings, sheets/fig _____

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).**

* Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rule 70.16 and 70.17).

** Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/CH 03/00700

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	1-13	YES
	Claims		NO
Inventive step (IS)	Claims	1-13	YES
	Claims		NO
Industrial applicability (IA)	Claims	1-13	YES
	Claims		NO

2. Citations and explanations

1. This report makes reference to the following documents:

D1: EP-A-0 936 671 (HITACHI LTD) 18 August 1999

D2: WO 99/38196 (JACOBS RICHARD L) 29 July 1999

D3: US 6 393 130 B1 (STONICAS R ET AL) 21 May 2002

D4: DE 196 25 240 A1 (MITSUBISHI DENKI) 30 April 1997

D5: DE 100 06 211 A (VIP VIRANT D O O) 30 August 2001

D4 is not cited in the international search report.

2. Independent claim 1

- 2.1 D1 is regarded as the prior art closest to the subject matter of claim 1 and discloses (the reference in parentheses are to D1):

- a power semiconductor module having a housing made of a curable encapsulating plastic (paragraphs 12, 16, 17; figures 1, 2) and
- having a base plate, electrical power semiconductor components being mounted on a portion of the base plate surface facing the housing with an insulating layer between the

components and the base plate (paragraphs 12, 24; figures 1-6) and wherein

- at least the portion of the base plate surface facing the housing, together with the mounted electrical semiconductor components, is encapsulated by the housing (paragraph 12; paragraph 30, point 1; figures 1-6).

2.2 Thus the subject matter of claim 1 differs from the power semiconductor module known from D1 in that:

- the curable encapsulating plastic has a hardness of an order of magnitude of 30 to 95 shore A, and
- the curable encapsulating plastic is a thermoplastic hot melt adhesive.

2.3 The subject matter of independent claim 1 is therefore novel (PCT Article 33(2)).

2.4 The problem to be solved by the present invention can therefore be regarded as that of reducing undesired stresses and resultant cracking in the housing when the housing heats up from operation of the power semiconductor module.

2.5 An electronic component having a semiconductor chip mounted on a base plate is known from D2, the semiconductor chip being encapsulated by a plastic molding compound (see D2: page 17, line 17 to page 18, line 3; figure 1). In order to reduce undesired stresses when the housing heats up, an elastomer is used as an encapsulating plastic as material with a low elasticity modulus (see D2: page 20, line 12 to

page 22, line 2). In D2, silicone (silicone rubber) is also mentioned as an elastomeric material, which can also be used as an encapsulating plastic (see D2: page 22, lines 3-4).

A person skilled in the art would, when selecting the material, take other properties, such as the hardness, into account (see, for example, D2: page 63, lines 5-9). D2 also discloses, in this connection, the technical feature whereby the encapsulating plastic has a hardness of an order of magnitude of 30 to 95 shore A (see D2: page 41, lines 9-15 in conjunction with page 42, lines 12-17). This range of values appears to lie within the scope of what is commonplace for the hardness of housings made of elastomers for encapsulating electronic components (see, for example, D3: column 2, lines 37-41; column 6, lines 54-59; figures 4A, 4B; claims 1, 8 and 9).

This technical feature therefore cannot be regarded as inventive (PCT Article 33(3)).

- 2.6 However, it is not obvious, proceeding from the teaching of D2, for a person skilled in the field of power semiconductor technology to use a thermoplastic hot melt adhesive to encapsulate electronic components in order to solve the stated problem. Although the use of thermoplastic hot melt adhesives for encapsulating electronic devices or electronic components is disclosed in D5 (see D5: column 2, line 47 to column 3, line 17), a person skilled in the art would not be prompted by this document to use a thermoplastic hot melt adhesive, owing to its elastomeric properties, as the encapsulating plastic for forming a housing for a power semiconductor

as elastomeric material for forming a housing for a power semiconductor module therefore involves an inventive step within the meaning of PCT Article 33(3).

2.7 The subject matter of independent claim 1 therefore involves an inventive step within the meaning of PCT Article 33(3).

3. Claims 2 to 6 and 8 to 13 are dependent on claim 1 and therefore also meet the PCT requirements for novelty and inventive step within the meaning of PCT Article 33(2) and (3).

4. Claim 7 is also considered to be an independent claim (see the objection regarding clarity raised in point 5.2 below). D4 is considered to be the prior art closest to the subject matter of this claim (see D4: column 1, lines 3-7; column 16, line 68 to column 18, line 41; figures 9-11).

The subject matter of this claim also involves an inventive step within the meaning of PCT Article 33(3) in relation to a combination of D2 and D4 for the reasons listed in the preceding point 2.5.

5. Clarity of the claims

5.1 The phrase "a hardness of an order of magnitude of 30 to 95 shore A" in claim 1 is vague and unclear because a precise value range for the hardness cannot be derived from this phrase (PCT Article 6).

5.2 Although claim 7 is worded as a dependent claim, it does not contain all the features of independent claim 1, to which it refers. According to claim 7, the electrical power semiconductor components are

mounted substantially directly on the base plate surface facing the housing, whereas, according to independent claim 1, these components are mounted on the base plate surface facing the housing with an insulating layer between the components and the base plate (PCT Article 6 in conjunction with PCT Rule 6.4(b)).

Furthermore, the phrase "*mounted substantially directly*" in claim 7 is vague and unclear because the technical features accompanying this phrase are not clear (PCT Article 6).

- 5.3 The term "cable" in claims 12 and 13 is vague and unclear because the technical features accompanying this term are not clear to a person skilled in the field of power semiconductor modules from claims 12 and 13 (PCT Article 6).

In particular, the cable used here must also be able to withstand the thermal and mechanical demands during encapsulation of the module components with the curable encapsulating compound. However, corresponding technical features cannot be found in the present claims (PCT Article 6).

6. Claims 1 to 13 meet the requirements of PCT Article 33(4) because they are industrially applicable.

